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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003904582 for a patent by SCALZO AUTOMOTIVE RESEARCH P/L as filed on 25 August 2003.

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Twentieth day of January 2004

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ENGINE MECHANISM.

This invention relates to an internal combustion engines mechanism to achieve a practical Atkinson Cycle motion in which the power stroke, of a four-stroke cycle, is substantially longer than the induction stroke. An Atkinson Cycle is acknowledged to contribute substantially to fuel economy improvements in a motor vehicle applications.

The original Atkinson Cycle mechanism was of huge proportions and not practical for automotive use, however, a method to simulate an Atkinson Cycle was developed and known as the Miller Cycle engine. In this arrangement a conventional engine mechanism is used. A late closing of the inlet valve allows some of the induced charge to be expelled into the manifold and effectively reduces the induced air volume. However, this method is not as effective as achieving the reduced induction stroke by the mechanical means described in this invention.

It is the objective of this invention to present an improved mechanisms for achieving a true Atkinson Cycle mechanism in which the induction and compression strokes are short but with the power and exhaust strokes long. This arrangement allows the combustion to expand over a longer distance and thus extract more work from the charge leading to improved fuel consumption. Further fuel economy improvements can be achieved with the mechanism allowing the compression ratio to be varied during operation and thus also allowing turbochargers and supercharges to be used for optimum performance and economy.

These features and advantages of the invention will be more fully understood from the following description of a preferred embodiment taken together with the accompanying drawings.

In the drawings:

Figure 1 is a transverse cross sectional view of one piston/crank assembly of a multi-piston engine, with the piston at the top-dead-centre position at the beginning of the power stroke. .

Figure 2 is a transverse cross sectional view of one piston/crank assembly of a multi-piston engine, with the piston at the bottom-dead-centre position at the end of the power stroke.

Figure 3 is a transverse cross sectional view of one piston/crank assembly of a multi-piston engine with the piston at the top-dead-centre position at the end of the exhaust stroke.

Figure 4 is a transverse cross sectional view of one piston/crank assembly of a multi-piston engine with the piston at the bottom-dead-centre position of the induction stroke..

Figure 5 is a graph showing the relation of piston stroke relative to crank angle over two complete four-stroke cycles.

Referring to Figs. 1 to 4 of the drawings, an internal combustion engine 10 having a cylinder block 12 defining one of many cylinder bores 14. The cylinders 14 are closed at one end by a cylinder head which is provided with the usual inlet and exhaust ports, valves, actuating gear and ignition means, none of which are shown.

Piston assembly 16 moves in bore 14 and connects to the rocking member 18 via connecting rod 20 and forked link 22. Connecting rod 20 is pivotally connected to the piston 16 via gudgeon pin 24, and pivotally connected to the forked link 22 via pin 26. The other end of the forked link 22 is pivotally linked to the rocking member 18 by pin 28 fixed on either side of the rocking member 18. The axes of pins 24, 26 and 28 are parallel to each other. Rocking member 18 is pivotally supported on shaft 30 in a selected geometric position longitudinal along the engine block 12 and parallel to the engine crankshaft 32 and all of the pins 24, 26 and 28. Shaft 30 rotatable on bearings (not shown) within the engine block 12 webs separating the cylinder bores 14 and crankshaft 32 conventional main bearings (not shown). Shaft 30 has eccentric pin 34 rotatably connected to connecting rod 36 linked to forked link 22 via pin 38.

The rocking member 18 connects to the crankshaft 32 via connecting rod 40, pin 28, fixed at either end to the rocking member 18, and crankpin 42. In this embodiment, connecting rod 40 shares the same pin 28 with the forked link 22 connecting to oscillating member 18, however an additional pin can be suitably located within an enlarged rocking member 18 allowing the connecting rod 40 and crankshaft 32 to be positioned at a different location on either side of the crankcase 12 relative to the cylinder bore 14.

The Atkinson cycle is achieved by rotating shaft 30 and thus eccentric 34 at half the rotational speed of crankshaft 32 preferably but not compulsory in the same direction of crankshaft 32. Therefore, shaft 30 is permanently connected by gears or chain drive, not shown, to crankshaft 32 with a fixed ratio of one to two respectively. Shaft 30 has the added function of supporting the oscillating rocking member 18.

Thus the piston 16 linear motion is transferred to the crankshaft 32 via connecting rod 20, forked link 22, rocking member 18 and connecting rod 40. Shaft 30, eccentric 34 and connecting rod 36 control the variation of stroke of piston 16. The rotational position of eccentric 34 relative to the crankshaft 32 position is pre-determined to achieve the desired geometric relationship for an Atkinson Cycle.

The geometry of the linkage system as represented in Fig. 1 shows the engine 10 with the piston 16 at top-dead-centre and with the relative positions of eccentric 34 and crankshaft 32, the engine is at the beginning of the power stroke.

Figure 2 represents the engine 10 in the bottom-dead-centre position at the completion of the power stroke. The eccentric 34 has rotated 90 degrees to the crankshaft 32, 180 degrees.

Figure 3 represents the engine 10 in the top-dead-centre position at the completion of the exhaust stroke and the beginning of the induction stroke. The eccentric 34 has rotated a further 90 degrees to the crankshaft 32, a further 180 degrees

Figure 4 represents the engine 10 in the bottom-dead-centre position at the completion of the induction stroke and the beginning of the compression stroke. The eccentric 34 has rotated a further 90 degrees to the crankshaft 32, a further 180 degrees

It is to be noted that throughout the variations of stroke of the piston 16, the action of the eccentric 34 via connecting rod 36, is to allow the forked link 22 pivoting on pin 28, to expand and contract, relative to the rotational position of shaft 30.

Figure 5 is a typical graphical representation of the piston 16 movement relative to the rotational angle of the crankshaft 32. It is to be noted that the Induction and Compression strokes are short with the Power and Exhaust strokes long. Such an engine will extract more work from a given amount of fuel and thus contribute to improved economy.

By introducing variable timing between the shaft 30 and crankshaft 32 (in a similar manner to a variable valve timing mechanism in conventional engines) the characteristics of the Atkinson Cycle can be altered as desired, as well as having the ability to alter the compression ratio, further improving the efficiency of the engine.

It is to be understood that this mechanism can be applied to various configurations of internal combustion engines, such as horizontally opposed engine, V-engines as well as in-line engines.

The scope of the invention need not be limited to the mechanism shown, Variations in the positioning of the crankshaft, the rocking member and linkage geometries to achieve the same outcome, fall within this invention.

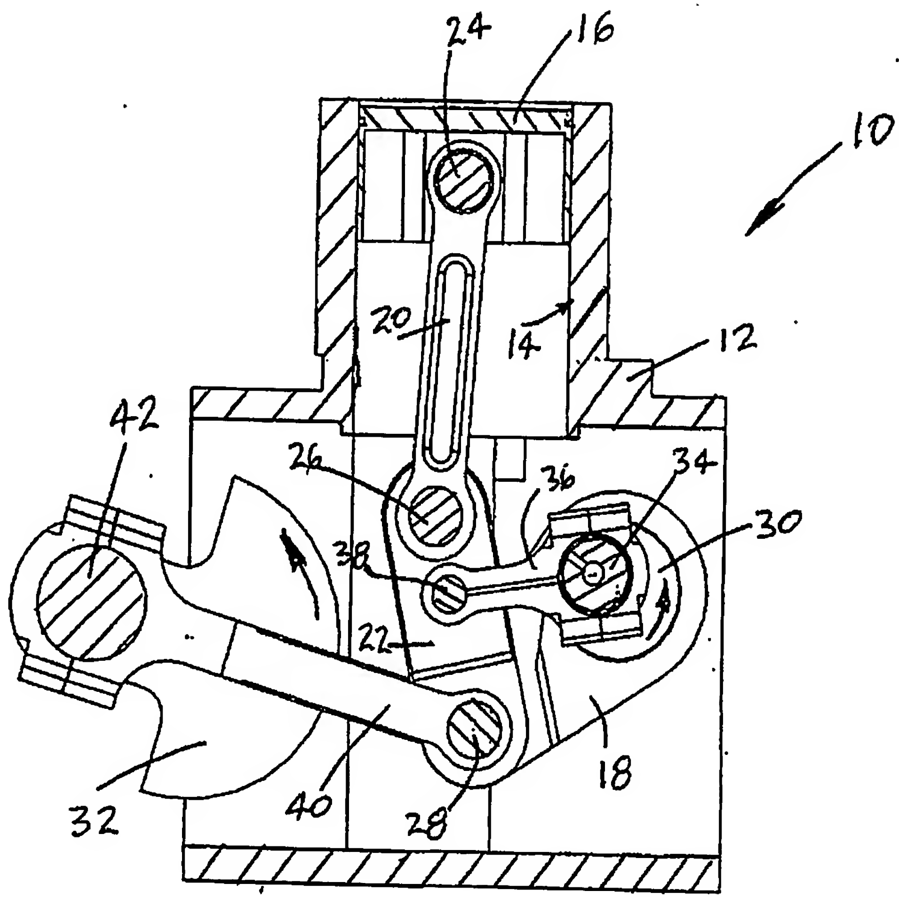

FIG. 1

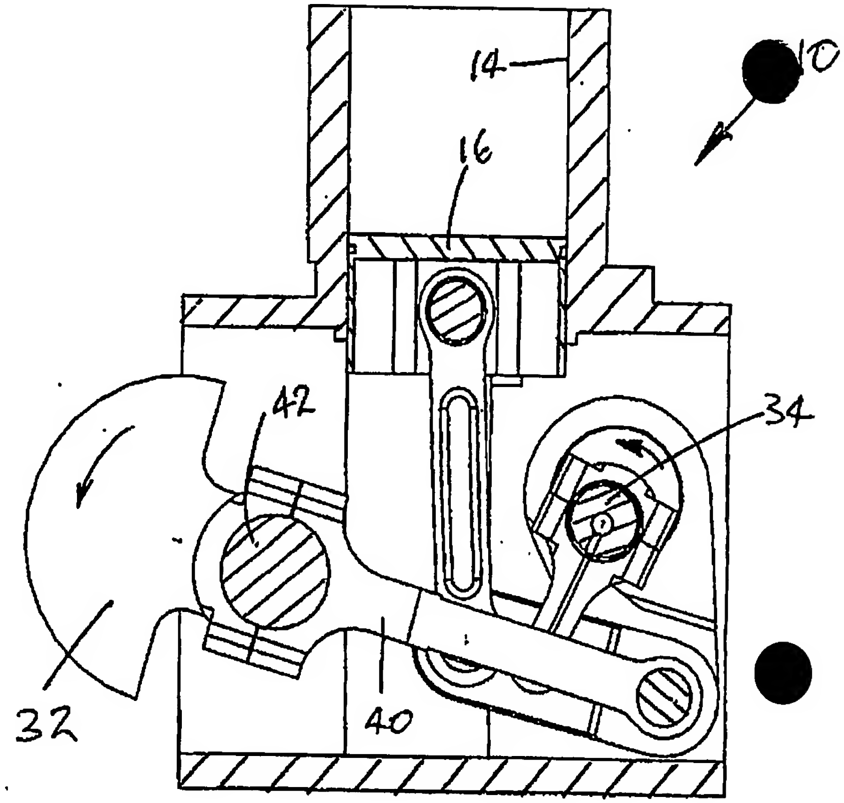

FIG. 2

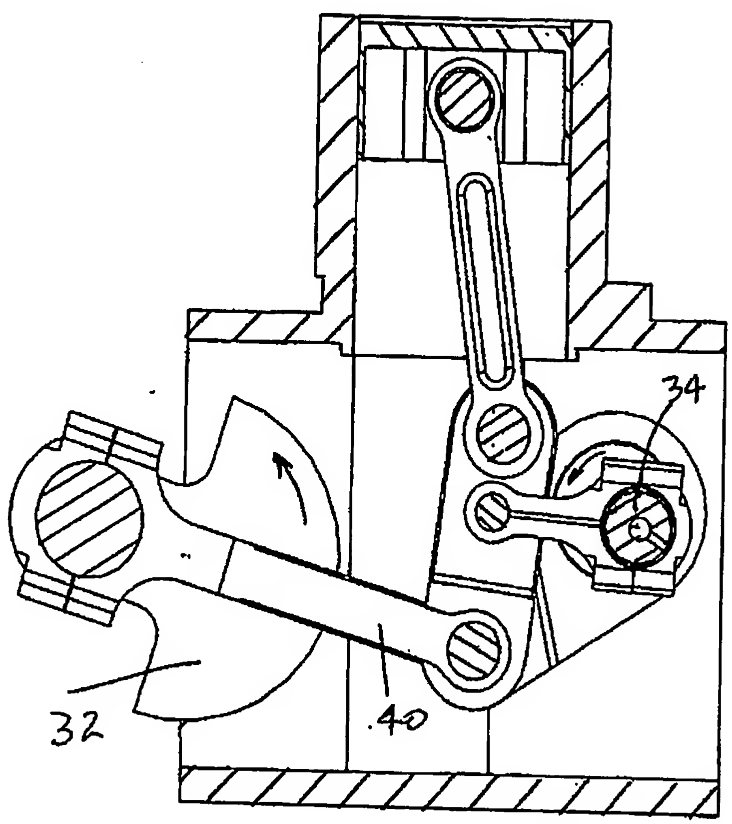

FIG. 3

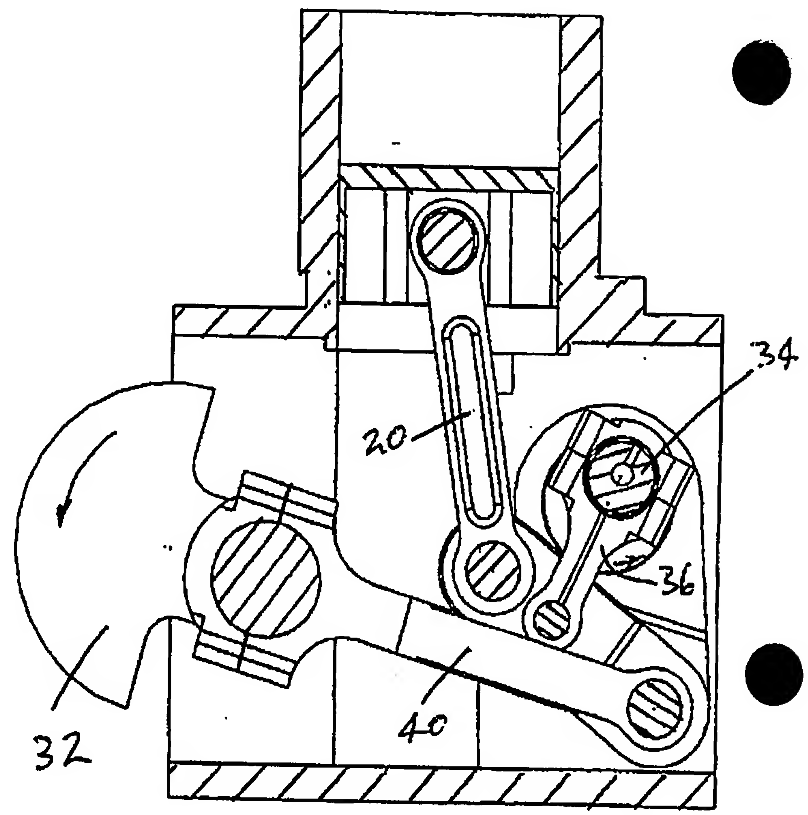

FIG. 4

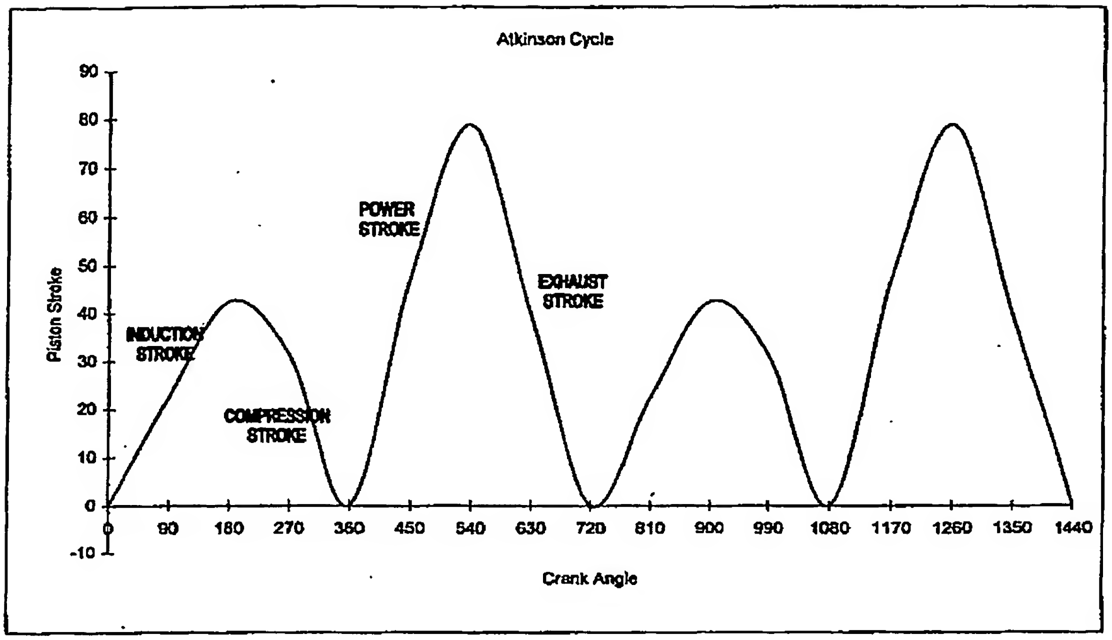
Atkinson Cycle
Piston Stroke
Crank Angle
INDUCTION STROKE
COMPRESSION STROKE
POWER STROKE
EXHAUST STROKE
90
80
70
60
50
40
30
20
10
0
-10
0
90
180
270
360
450
540
630
720
810
900
990
1080
1170
1260
1350
1440

FIG. 5